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Sleep Loss and Fatigue in Healthcare Professionals

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Sleep loss and impairments related to resultant fatigue are common among professionals working in healthcare settings. Long continuous duty hours, reduced opportunities for sleep with minimal recuperation time, and shift work all contribute significantly to impairments in physical, cognitive, and emotional functioning. Detrimental effects include those on personal health and well-being, patient health and safety, performance of job-related tasks, and professionalism. Many challenges exist to implementing effective personal and systemwide strategies to manage the impact of sleep loss. Therefore, adopting fatigue management strategies that have been successful in other occupational settings and developing specific interventions that are appropriate for the hospital setting are key. The following review outlines the causes and consequences of sleep loss and fatigue in healthcare professionals, and provides an empirically based framework for developing strategies to recognize, address, and manage sleep loss and fatigue. **Key words:** *fatigue*, *healthcare professionals*, *sleep*

Acute and chronic sleep loss, whether partial or complete, substantially impairs physical, cognitive, and emotional functioning in human beings. In addition, the influence of circadian physiology dictates that wakefulness and alertness are at optimal levels during daylight hours, and that sleepiness is maximized during the night. Failure to adhere to this need for both adequate amounts of and appropriately timed sleep results in an increase in sleepiness and fatigue levels and a decline in waking function. This is likely to be relevant to performance of daily tasks, particularly in the context of occupational settings.

However, modern society expects performance and productivity on a 24-hour basis. This need for round-the-clock operations in many spheres, including healthcare, often assumes precedence over the basic physiologic principles governing sleep and wakefulness. In particular, long continuous or contiguous shifts, reduced opportunities for sleep, and minimal recuperation time traditionally experienced by healthcare professionals impact their work and the quality of patient care, their health and well-being, and the quality of their educational experience.

To further compound this issue, most healthcare professionals, including nurses, typically receive little or no formal education about normal sleep and circadian rhythms, or the essential role of sleep in maintaining adequate health and performance either during or after their training.[1] Operational measures such as the work shift limitations for nurses implemented by many hospitals and the work hour regulations for resident physicians instituted in 2003 by the Accreditation Council for Graduate Medical Education are important steps in creating the opportunity for healthcare professionals to experience adequate rest. However, education is necessary to affect any substantial and sustained behavioral change on the individual level (ie, the individual needs to understand the rationale for the changes to buy into them, and also to accept personal responsibility for instituting them). Education is also often the only vehicle for producing changes in lifestyle or personal behaviors that impact fatigue and alertness

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(such as the amount of sleep obtained by healthcare workers when they are off-duty, and "moonlighting" practices), because these behaviors are not likely to be amenable to external regulation. Finally, education is a critical part of causing change at the social dynamic level. This is because one of the most powerful identified barriers to reducing sleep loss and fatigue, the "culture" of the medical workplace, often equates the number of hours on the job and hours without sleep with professionalism and dedication to patient care.

The goal of the following review of the causes and consequences of sleep loss and fatigue in the healthcare setting is to increase the level of awareness and knowledge base of healthcare professionals in general, and hospital-based nursing personnel in particular. An additional goal is to provide a framework for developing strategies both at the systems level and at the individual level for addressing and managing sleep loss and fatigue. Basic principles of sleep and chronobiology are briefly reviewed, followed by a discussion of the impact of sleep loss on healthcare workers' personal and professional lives, including performance of work-related tasks, their own health and safety, and patient safety. Because of the relative preponderance of studies examining sleep loss and fatigue in the context of medical training, some portion of the literature cited below involves physicians. However, the vast majority of principles apply equally to nurses, nurse practitioners, nurse midwives, and other healthcare professionals. The latter part of the review presents empirically based information, including strategies that have already been developed in other industries facing similar needs (eg, transportation and aeronautics) regarding the use of fatigue countermeasures such as napping, optimal sleep health behaviors, and other information to aid in the development of individualized alertness management strategies.

BASICS OF SLEEP

The framework or architecture of sleep is based on 2 distinct sleep stages: rapid eye movement (REM) sleep and non-REM sleep. These stages are defined by distinct polysomnographic features of EEG patterns, eye movements, and muscle tone.

- *Non-REM* sleep (75%–80% of sleep in healthy young adults) may be viewed as a period of relatively low-brain activity during which the regulatory capacity of the brain is actively ongoing and in which body movements are preserved. Non-REM sleep is further divided into:
  - *Stage 1* sleep (2%–5% of total sleep time), which occurs at the sleep-wake transition and is often referred to as "light sleep."
  - *Stage 2* sleep (45%–55%), which is characterized by bursts of rhythmic rapid EEG activity and high-amplitude slow wave activity.
  - *Stages 3 and 4* sleep (3%–23%) also known as "deep" sleep, slow wave sleep, or delta sleep. The highest arousal threshold (most difficult to awaken) occurs during stages 3 and 4 sleep. Delta sleep is generally considered the most restorative stage of sleep, and the one that tends to be preserved if the total amount of sleep is restricted. The relative percentage of delta sleep is also increased during the recovery sleep that follows a period of sleep loss.
- *REM sleep* (20%–25%; 4–6 periods per night) is characterized by paralysis or nearly absent muscle tone (except for control of breathing), high levels of cortical activity that are associated with dreaming, irregular respiration and heart rate, and episodic bursts of phasic eye movements that are the hallmark of REM sleep. This stage of sleep in particular is believed to play a key role in memory consolidation.

Non-REM and REM sleep alternate throughout the night in cycles of about 90 to 110 minutes. The relative proportion of REM and non-REM sleep per cycle changes across the night, such that slow wave sleep predominates in the first third of the night and REM sleep in the last third. When sleep is fragmented, for example, by frequent interruptions during the night, the result is an inadequate period of consolidated sleep, and very little time spent in the most important stages of sleep (stages 3 and 4 and REM).

Wakefulness and sleep are highly regulated states that are governed by what is known as the "2-process model." This model basically represents the interaction between the *homeostatic drive for sleep*, which primarily regulates the length and depth of sleep, and endogenous *circadian rhythms* ("biological time clocks"), which influence the internal organization of sleep and timing and duration of daily sleep-wake cycles.[2] The homeostatic sleep drive increases steadily during periods of wakefulness, reaching a maximum in the late evening (ie, near usual bedtime). The circadian system is modulated by the hypothalamus, in particular the suprachiasmatic nucleus, and involves the secretion of the sleep-inducing hormone melatonin. The circadian rhythm of sleep and wakefulness is characterized by predictable, clock-dependent periods of maximum sleepiness ("circadian trough"; eg, 3–5 AM and PM) and maximum

alertness ("circadian peaks") throughout the day and night.

Optimal mental performance requires a combination of adequate sleep and circadian wakefulness.[3] For example, when adults get less than 5 hours of sleep per night, the homeostatic drive to sleep increases sharply. This results in an increased propensity to sleep and a decline in cognitive performance. Deficits in attention and vigilance begin to occur after 15 to 16 hours of continued wakefulness in experimental conditions.[4] In individuals on a shift work schedule, the normal circadian sleep-wake rhythm is inverted. Thus, the individual has to be alert and functional during the period of intrinsic low-circadian alertness, and needs to sleep during the day when he or she is usually active and alert. Alertness levels are also influenced up to a degree by both external (eg, noise, light, environmental stimulation) and internal (eg, motivation to remain awake, other physiologic states such as hunger) factors. However, contrary to popular belief, it is fundamentally a lack of sleep and not these factors (room temperature, a heavy lunch, or a boring lecture) that causes sleepiness.

From a practical standpoint, *excessive daytime sleepiness* may be due to 4 basic mechanisms that may occur independently or in combination. These include:

- *Insufficient sleep:* An insufficient quantity of sleep results from an individual getting less sleep than is needed to be optimally rested, which most experts agree is typically between 6 and 10 hours of sleep per 24-hour period for adults, with most individuals requiring approximately 8 hours of sleep per day to maintain an optimal level of alertness.
- *Fragmented sleep:* Sleep may be of adequate duration, but still result in daytime sleepiness if disrupted or of poor quality; for example, attempts at daytime sleep by night shift workers may be fragmented by interruptions from phone calls, family members, etc, as well as by even the anticipation of being interrupted during opportunities to sleep.
- *Underlying circadian rhythm abnormalities:* Circadian rhythm disruptions result from a mismatch between environmental demands on the individual and endogenous circadian sleep-wake rhythms (eg, working night shifts).[5] Because the internal periodicity of the human circadian clock is slightly longer than 24 hours, it is easier to stay up later (delay sleep) than to try to fall asleep earlier (advance sleep time). For the same reason, it is also easier to adapt to shifts that rotate in a forward (clockwise) direction (day-evening-night), just as it is easier to adjust to travel across time zones flying west than flying eastward. "Night owls," who normally have a tendency to fall asleep and wake later, may find it easier to adapt to night shifts.[6] However, most sleep experts agree that human beings in general never fully adjust to working night shifts.
- *Primary sleep disorders:* Finally, primary sleep disorders such as obstructive sleep apnea, restless legs syndrome and periodic limb movement disorder, and insomnia are also important causes of excessive daytime sleepiness.

An additional confounding factor should be mentioned that has particular relevance to the nursing profession, and that is the unique contribution of the menstrual cycle, pregnancy, and menopause to the quality and quantity of sleep in working women. A number of excellent reviews have summarized the current literature regarding the impact of progesterone and estrogen on sleep, sleep patterns during pregnancy and in the postpartum period, and sleep stability and fragmentation in perimenopausal and menopausal women.[7,8]

IMPACT OF SLEEP LOSS AND FATIGUE

There is considerable empirical evidence to support the conclusion that sleep restriction has negative effects on neurobehavioral (sustained attention, reaction time, vigilance, etc) and cognitive (memory, reasoning, etc) performance in humans.[9] Tasks requiring both speed and accuracy (eg, performing emergency procedures such as intubating a patient) demonstrate considerably slowed speed before accuracy begins to fail, and if an individual experiences restricted sleep for just a few days, the result is significantly slower response times. Although in experimental settings, adults who get 4 hours of sleep can function reasonably well for short periods (2–3 days), performance of tasks requiring sustained attention is still clearly suboptimal, even in the short run. With decreased sleep, higher order cognitive tasks are affected early and disproportionately. After one night of missed sleep, for example, cognitive performance may decrease as much as 25% from baseline; after the second night of missed sleep, cognitive performance could fall to nearly 40% of baseline.

Furthermore, any discrepancy between the amount of sleep needed by an individual and the amount of sleep actually obtained, even for one night, begins to build up a "sleep debt." This sleep debt continues to accumulate over time until adequate recovery sleep is obtained. For example, an experiment measuring waking neurobehavioral functions during chronic sleep restriction demonstrated that restriction of sleep to 6 hours or less per night produced cognitive deficits equivalent to up to 2 nights of total sleep deprivation.[10] Furthermore, many studies[4,10–13] have clearly demonstrated

that human beings do not simply adapt to a state of chronic sleep loss by "learning to function" on less than adequate amounts of sleep.

To date, there are well over a hundred studies in the literature on sleep loss and fatigue, specifically in healthcare professionals that have examined specific effects on a variety of different performance measures. These outcome variables may be broadly categorized as effects on (1) neurocognitive and psychomotor functioning in the laboratory setting, (2) performance of simulated work-related tasks and of occupational tasks in actual work settings, and (3) mood and psychological state. A number of reviews have summarized the negative impact of sleep loss and fatigue[14–18]; most recently, a 2005 meta-analysis of 60 studies on the effect of sleep deprivation found that continued wakefulness for less than 30 hours reduced physicians' overall performance by nearly 1 SD and clinical performance by more than 1.5 SDs. Subjects demonstrated a decline in vigilance, memory, and cognitive as well as clinical performance.[19]

Results from a number of survey studies suggest that prior to the institution of duty hour regulations, many physicians-in-training worked more than 80 hours per week, and 100 to 120 hour workweeks were common.[20,21] Data regarding hours of continuous wakefulness on duty range from 38 hours[22] to 46 hours[23] without sleep. Ironically, the recent institution of work hour regulations for resident physicians may in some circumstances have led to an increase in working hours for nursing staff, as more clinical nurse managers, nurse practitioners, and midwives are being asked to cover nights, weekends, and extended shifts. Recent research has indicated that fatigue and sleep loss among the nursing population is also becoming more problematic as a result of the nursing shortage currently faced by healthcare facilities. In addition, as more nurses function in the role of primary provider for the family, extended work shifts, overtime, and number of hours worked per week are likely to increase, with significant effects on nursing personnel's overall performance.[24]

Furthermore, in addition to restricted sleep, there are multiple other factors that potentially magnify the effects of inadequate sleep in medical settings. These include frequent interruptions during on-call sleep periods, leading to fragmented and poor quality sleep; shift work–related interruption of normal circadian sleep-wake rhythms; and "sleep inertia" (characterized by confusion, poor judgment, inappropriate decision making, and impaired recall of events occurring immediately upon arousal, particularly from deep sleep).[25,26] Inadequate off-duty "recovery sleep,"[27] particularly common in situations in which the healthcare worker is solely responsible for childcare responsibilities, also plays an important role. As a result, many healthcare professionals report levels of sleepiness that are equivalent to those found in some clinical populations of patients with sleep apnea or narcolepsy when measured by standardized instruments of sleep propensity in different situations (eg, riding in a car, in the midst of a conversation) such as the Epworth Sleepiness Scale.[28]

Consequences related to sleep loss and shift work in healthcare workers, such as those in any occupational setting, are potentially broad in scope and are likely to occur in a number of domains. They include:

- *Personal and family consequences* such as poor sleep quality and more sleep problems,[29] mood disturbances, increased stress, adverse health consequences, negative effects on personal relationships, increased potential for alcohol and substance abuse, and increased risk of motor vehicle crashes. Self-perceived negative effects on mood, motivation, and life satisfaction as a result of chronic sleep loss are almost universally reported in occupations that involve prolonged periods without sleep. For example, nurses working night shifts report more depressive symptoms than those on day shifts,[24] and medical trainees getting less sleep reported an increased alcohol intake, notable weight change, and an increased likelihood of taking medications to stay awake and to cope with residency.[30,31]
- One of the more dangerous consequences of sleep loss is a significant decrement in attention and reaction time that has been shown to have a measurable impact on driving a motor vehicle. Fall-asleep car crashes are a predictable consequence of sleep loss in healthcare workers.[32–36] For example, a recent study examining the frequency of documented motor vehicle crashes and "near misses" following extended (>24 hours) shifts reported a 2-fold increase in these incidents compared with shorter shifts.[32] A survey of nurses in Massachusetts found that individuals working rotating shifts had twice the risk of "nodding off" while driving to or from work as compared with those working fixed shifts.[37] Another study of nurses working night or rotating shifts found a 7-fold increase in drowsy driving behaviors.[38] Finally, a recent study of medical residents compared their performance on a driving simulator when rested, sleep-deprived (postcall), and moderately intoxicated conditions; in the sleep-deprived conditions, residents' performance was comparable to or worse than it was in the intoxicated condition.[39]

- *Impact on the performance of professional duties* (including procedures such as intravenous insertion, cognitive tasks such as clinical decision making, and patient-related behaviors such as communication skills). In general, tasks dependent upon high and/or sustained levels of vigilance, those of longer duration, and those that involve newly learned procedural skills appear to be more vulnerable to the effects of short-term sleep loss. As noted above, efficiency of performance on "real-world" tasks is often sacrificed in favor of preserving accuracy, a factor that could have significant impact in situations that require both speed and precision.
- *Implications for the quality of professional education* (decreased retention of information, impaired information processing, and decreased motivation to learn). One study, for example, reported that satisfaction with learning, amount of time with attending physicians, and rating of quality of time with attending physicians increased with increasing hours of sleep. Both medical students[20] and residents[40] have reported a negative correlation between long working hours and effective learning and use of skills.
- *Impact on the quality of patient care and on commission of errors in the hospital setting*, a particular concern in this era of increasing accountability in healthcare. Several recent studies of hospital nurses have indicated that significantly decreased levels of alertness and vigilance, as well as an increased likelihood of errors and near errors, were associated with extended duty shifts, and are increasingly common.[41,42] This increased risk of committing errors transcends professional specialties. For example, one study suggested that house staff averaging 5 hours or less of sleep per night were significantly more likely to report having made a serious medical error and were more likely to have been named in a malpractice suit.[30,31] A more recent study[43] assessed medical errors in a group of medical interns working during a 30-hour shift schedule and during a schedule in which shifts were limited to 16 hours. Interns made 36% more serious errors and the rate of diagnostic errors was 5.6 times higher during the traditional schedule. Studies utilizing simulated laparoscopy, for example, have found significantly more errors and more time to perform surgical procedures are associated with increasing sleep loss and on mornings postcall, even in experienced surgeons. In a study of pediatric residents, significant differences on efficiency of performance on several simulated tasks including intubation, vein catheterization, and arterial catheterization were found after 24 and 36 hours of continued wakefulness.[44] Furthermore, healthcare workers in emergency medicine may be particularly vulnerable because of additional effects on performance of circadian rhythm disruption. For example, one study of sleep-deprived second year residents demonstrated significant reductions in comprehensiveness of the clinical encounter as measured by the number of items documented on history and physical examination.[45]

The fatigue associated with working extended hours is not only a concern for patient safety but also seems to be contributing to absenteeism and job dissatisfaction among registered nurses. Long and often unpredictable hours to cover staffing vacancies added on to often unrealistic workloads have essentially led to nurse burnout. In a recent study, job dissatisfaction among hospital nurses was found to be 4 times greater than the average for all workers in the United States, and 1 in 5 hospital nurses reported that they intend to leave their current jobs within a year. It was also found that higher emotional exhaustion and greater job dissatisfaction in nurses were strongly and significantly associated with patient-to-nurse ratios.[46]

An understudied but potentially important area affecting patient care and safety in which sleep loss and fatigue may have a significant impact is professionalism, which in medical settings is characterized by such constructs as attitudes toward and interactions with patients and their families, interactions with other staff members, empathy, role acceptance, and attitudes toward one's profession. In one study, medical residents described themselves as inattentive and emotionally unavailable in their relationships with patients, having difficulty listening to patients, and being much more directive in their discussions with patients when sleep deprived, as well as having less patience with and compassion for patients and families.[28] This is clearly an area that deserves further examination in the nursing profession as well.

MANAGING SLEEP LOSS AND FATIGUE

The only truly effective intervention for sleep loss and fatigue, not surprisingly, is adequate sleep. However, there is a high probability that some degree of sleep loss and fatigue will be experienced by most healthcare personnel in their professional lives, both in the course of training and in the performance of their regular jobs. Thus, the ability to recognize and then develop strategies to address sleepiness in oneself (as

well as in colleagues) is essential to mitigating its effects. Because sleep needs, tolerance to sleep loss, and non–work-related demands vary somewhat across individuals, healthcare professionals need to develop a sense of both their personal vulnerability to fatigue and the approaches that work best for them and their lifestyle.

To that end, it is important to recognize that most individuals' perception of their own level of sleepiness and associated impairments is poor, resulting in a tendency to underestimate subjective sleepiness. Furthermore, even the ability to detect actual sleep onset in sleep-deprived individuals is often compromised; for example, when residents in one study were asked to indicate whether or not they had fallen asleep during formal testing in a sleep laboratory, self-perception of whether they had remained awake or they had fallen asleep was no better than chance.[27] This is particularly important in considering the operational consequences of "feeling fit for duty" (or driving home after a duty shift) when, in fact, the opposite might be true.

The use of both personal strategies or *countermeasures* to fatigue (eg, napping, strategic caffeine consumption, good sleep hygiene, avoiding "driving drowsy") and systemwide interventions (eg, shift work strategies, duty hour limitations, "night float" rotations) to address sleep loss and fatigue has been extensively studied in other occupational settings. It should be kept in mind that, to date, only a handful of studies have specifically addressed the issue of countermeasure strategies in healthcare professionals. One review[47] examined the impact of shift work in the emergency department settings and proposed the use of both operational and personal strategies to optimize alertness. These included rotation schedule designs based on chronobiologic principles, use of regular exercise, exposure to light on and off the job, and sleep strategies such as anchor sleep, split sleep periods, and planned napping.

- *Naps:* The strategic use of naps has been shown in a number of occupational settings (aviation, trucking, etc) to provide temporary relief from the effects of sleep loss and fatigue. For example, "prophylactic" brief naps prior to 24 hours of sleep loss have been shown to improve alertness during 24 hours of sustained wakefulness[48]; a 2- to 8-hour nap prior to 24 hours of sleep loss improves vigilance and minimizes sleepiness for 24 hours.[49] "Maintenance" or on-the-job naps may also improve performance in shift workers[50]; for example, frequent (every 2–3 hours), brief (15 minute) "therapeutic" naps can significantly mitigate performance decrements during periods of prolonged sleep deprivation.[51]

In all of these situations, however, consideration must be given to the optimal timing and duration of naps. For example, scheduled napping may be relatively easier to achieve during the circadian nadirs of wakefulness (3–5 AM and PM). Furthermore, the optimal duration of brief naps is 15 to 20 minutes. Individuals napping for this short duration are likely to avoid going into deep sleep, and thus the effects of sleep inertia upon awakening are minimized.[25]

- *Caffeine:* Caffeine is a central nervous stimulant commonly used to counteract the effects of sleep deprivation. A number of studies have shown that caffeine does have alertness-enhancing effects in relatively high doses. Caffeine takes effect within 15 to 45 minutes after consumption and remains active for 3 to 5 hours, thus strategic timing of consumption is critical. Caffeine effects also depend on body mass, age, food intake, and especially on previous exposure. Regular use tends to produce relative tolerance to its stimulatory effects and may result in physical dependence characterized by withdrawal symptoms (headache, dysphoria, fatigue) on cessation. Equally important, caffeine use may also result in more fragmented sleep and decreased total sleep time.[52,53]
- *Sleep hygiene:* Good sleep habits to improve the strength of the circadian rhythm, relaxing presleep rituals, and a comfortable sleep environment will lead to improved sleep quality and quantity.[54] Some simple good sleep habits are listed in Table 1.

Table 1. Principles of sleep hygiene

1. Maintain a regular and consistent bedtime and wake time that is similar on both work days and non–work days.
2. Develop a regular, relaxing bedtime routine about 1/2 h before sleep onset.
3. Establish comfortable sleeping conditions most conducive to good sleep (cooler room temperature, darkness, and low-noise levels).
4. Avoid going to bed hungry, but avoid heavy meals within 2 to 3 h of sleep onset.
5. Exercise regularly, but avoid vigorous exercise within 2 to 3 h of sleep onset.
6. Spend some time outside each day.
7. Avoid exposure to bright light in the evening before bed and encourage exposure to bright light in the morning on waking.
8. Avoid stimulants such as nicotine in the evening.
9. Do not use alcohol to facilitate sleep initiation; this is likely to result in sleep fragmentation later in the night as blood alcohol levels fall.

- *Avoiding drowsy driving:* Typically, drowsy driving crashes involve a single occupant driving off the road. The risk of a drowsy driving crash is significantly higher under conditions that increase drowsiness (eg, use of sedatives, alcohol) or minimize environmental stimuli (eg, driving on highway for long periods). The most common times of day for fall-asleep crashes are in the morning and in the mid-afternoon (when healthcare workers are often driving home after a shift). There are a number of warning signs (eg, nodding off at stoplights, difficulty focusing on the road, drifting from lane position) that indicate an increased risk for a drowsy driving accident. In many cases, however, by the time these behaviors occur, the individual has already been experiencing "microsleeps," which are brief intrusions of the sleep state into wakefulness without any subjective awareness of sleep.[55] Thus, the safest countermeasure for drowsy driving is to not drive (eg, get a ride home, take public transportation or a taxi, pull off the road and take a brief nap).

It should be noted that a number of these strategies require a cooperative effort among healthcare personnel, supervisors, and hospital administration. For example, napping before driving home postduty can be greatly facilitated by the provision of appropriate sleeping quarters by the hospital. Some hospitals have instituted operational measures such as an optional taxi service for workers who feel unsafe to drive home after work.

- *Managing shift work:* Another example of the need for shared responsibility among all stakeholders (eg, physicians, nurses, hospital administrators, trainees, professional regulatory bodies) for developing and incorporating effective and creative solutions for the problem of sleep loss and fatigue involves adaptation to night shifts. For example, many studies suggest that, although fatigue and poor sleep quality are issues for both day and night shift nurses, the former experience higher levels of fatigue and poorer sleep quality than the latter. The reasons for this are probably multifactorial. Because different physiologic systems in the body adjust to disruptions in circadian rhythms at different rates, night shift work may result in a number of psychological (ie, cognitive dullness, irritability) and somatic (eg, gastrointestinal tract symptoms) complaints, similar to those experienced in jet lag. Adjustment to working night shift, although probably never complete in most individuals, generally takes at least a week. Studies suggest that workers tend to lose 1 to 4 hours of sleep each night for approximately 3 days after a rotation to a new shift.

Strategies to assist in adapting to working the night shift include ensuring adequate sleep during off-work hours.[56,57] However, many night shift workers report that sleep during the day is often less rejuvenating than nighttime sleep, and shift workers are more vulnerable to sleep interruptions during the day from family, social pressures, and other responsibilities.[58] Thus, enlisting the cooperation of others is a key factor in ensuring adequate sleep. Napping strategies may include "prophylactic" naps before work, or splitting sleep into two 4-hour periods. Supervisors should also be sensitive to circadian factors when scheduling rotating shifts.[58] For example, as noted above, it is easier to adapt to shifts that rotate in a forward (clockwise) direction (day-evening-night). Several studies shown in nurses and midwives have also suggested that allowing personal choice regarding shift preference[59] and increased participation of healthcare workers in planning their own work schedule may decrease fatigue-related stress.[60] Finally, because light has such a powerful influence on circadian rhythms of alertness and sleepiness, its exposure should be maximized when alertness is desired (ie, at work) and minimized when a sleep period is planned (eg, driving home after the night shift).

Work shifts that start early in the morning (before 7 AM) also pose potential risks in terms of sleep loss and fatigue. Individuals working these shifts typically get less than adequate sleep due to the early rise time, and, in addition, may have disrupted sleep due to the phenomenon of "anticipatory awakenings," in which the deeper stages of sleep (slow wave sleep) may be reduced. Early rise times often also require the individual to become awake and alert at a time when they are physiologically most prone to sleepiness (circadian trough of alertness between 3 and 5 AM). These factors should be taken into account when scheduling shifts and assigning on-duty responsibilities.

Finally, length of shifts should incorporate basic principles related to the impact of prolonged wakefulness on performance. For example, the 2000 Institute of Medicine report on medical errors recommended minimizing the use of 12-hour shifts and limiting scheduled work periods to no more than 12 consecutive hours in a 24-hour period.[61]

SUMMARY

There is no question that the problem of sleep loss and fatigue is one that impacts significantly on the professional and personal lives of healthcare professionals

and of their patients. Because healthcare delivery in hospitals must operate 24 hours a day, 7 days a week, management, as well as elimination of fatigue when possible, should be the driving concept. Alertness management strategies should be informed by the growing body of research and policy experience from other occupational settings. However, because there are fundamental differences in the nature of the tasks that medical personnel are required to perform in the course of their work day, fatigue management strategies that have been successful in other occupational settings may not be uniformly applicable to medical settings. Therefore, strategies unique to the healthcare professions must continue to be developed and tested. It is clear that hospital and nursing administrators today are faced with significant challenges in this regard. Understaffing has become a major concern not only in terms of patient safety but also in terms of increased nurse turnover, which tends to yield increased hospital costs. Without improvements in nurses' working conditions, nurse-to-bed ratios, and greater regulation of hours worked, recruitment and retention are compromised. It is imperative that policies be set in place such that all healthcare workers perform at optimal levels to minimize adverse events and maximize the quality of healthcare.

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